

REMARKS

Claims 1-19 are pending in the present application. Claims 9 and 19 are amended above. New claims 20 and 21 are added above. No new matter is added by claim amendments. Entry is respectfully requested.

The Applicants note, with appreciation, that the Office Action of February 21, 2006 indicates at page 5, paragraph 4, that claims 10-19 are allowed.

Claims 1-4, 6 and 7 stand rejected under 35 U.S.C. 102(a) as being anticipated by Chern, *et al.* (U.S. Publication Number 2003/0102504). Claims 1, 2, 6 and 7 stand rejected under 35 U.S.C. 102(b) as being unpatentable over Kim, *et al.* (U.S. Publication Number 2002/0119615). Claims 5, 8, and 9 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Chern, *et al.* Reconsideration of the rejection and allowance of claims 1-9 are respectfully requested.

In the present invention as claimed in independent claim 1, a method of manufacturing a multi-thickness gate dielectric layer of a semiconductor device includes forming a first dielectric layer on a semiconductor substrate of a first thickness, forming a second dielectric layer of a second thickness on the top surface of the first dielectric layer, the second dielectric layer having a different dielectric material from that of the first dielectric layer, and further selectively removing a portion of the second dielectric layer with etch selectivity to the first dielectric so as to selectively expose a portion of the top surface of the first dielectric layer under the second dielectric layer to form a gate dielectric layer including a thick portion formed of the first dielectric layer and remaining second dielectric layer and a thin portion formed of the exposed first dielectric layer, the thin portion being of the first thickness and the thick portion being of a combined thickness of the first thickness and the second thickness.

Chern, *et al.*, discloses the formation of a nitride layer 48 on an oxide layer 46 in a semiconductor memory device (see FIG. 3C). The nitride layer 48 is etched in a peripheral area

34 of the device, while the nitride layer 48 in a memory cell area 32 of the device remains intact (see FIG. 3D). A thermal oxidation process is next used to thicken the oxide layer 46 in the peripheral area 34, while the nitride layer 48 in the memory cell area 32 operates as a mask so that the oxide layer 46 thickens only in the peripheral area 34 during the thermal oxidation process (see FIG. 3E). The nitride layer 48 in the cell area 32 is then removed. The resulting oxide layer 46 includes two portions, a thinner portion 72 in the memory cell area 32 and a thicker portion 74 in the peripheral area 34 (see FIG. 3F). The thinner portion 72 and the thicker portion 74 of the oxide layer 46 are both oxide layers, and thus are formed of the same dielectric material.

Chern, *et al.* fails to teach or suggest “forming a gate dielectric layer including a thick portion formed” of a “first dielectric layer and remaining second dielectric layer and a thin portion formed of the exposed first dielectric layer”, the “second dielectric layer having different dielectric material from that of the first dielectric material”, as claimed in claim 1 of the present invention. Instead, in Chern, *et al.*, the nitride layer 48 is used only as an etch mask and is then subsequently fully removed. The nitride layer 48 is not included in “a gate dielectric layer” of the resulting device and therefore is not a “dielectric layer” as claimed. The oxide layer 46 is grown in a thermal oxidation process in a peripheral region such that the resulting oxide layer 46 includes a thicker portion 74 and a thinner portion 72. However, the oxide layer 46 in the thicker portion 74 is of the same dielectric material as the oxide layer 46 in the thinner portion 72. Therefore, Chern, *et al.* fails to teach or suggest a “second dielectric layer having different dielectric material from that of” a “first dielectric material”, as claimed.

It is therefore submitted that independent claim 1 is allowable over Chern, *et al.* Reconsideration of the rejection of claim 1 under 35 U.S.C. 102(a) as being anticipated by Chern, *et al.*, and allowance of the claim, are respectfully requested. With regard to the rejection of dependent claims 2-4, 6 and 7 as being anticipated by Chern, *et al.* and claims 5, 8 and 9 as being unpatentable over Chern, *et al.*, it follows that these claims should inherit the allowability of the independent claim from which they depend.

Kim, *et al.* discloses the sequential formation of a pad oxide layer 103, a pad nitride layer 105, and a mask oxide layer 107 on a main surface of a semiconductor substrate 101 (see FIG. 13). A first photoresist layer 109 exposing a first region a of the device is formed on the mask oxide layer 107. The mask oxide layer 107 is etched using the first photoresist pattern 109 as an etching mask to form a patterned mask oxide layer 107a covering a second region b of the device (see FIG. 14). The pad nitride layer 105 is etched in the first region a using the patterned mask oxide layer 107a as an etching mask to form a patterned pad nitride layer 105a covering the second region b (see FIG. 15). The pad oxide layer is then etched using the patterned pad nitride layer 105a as an etching mask to form a patterned pad oxide layer 103a covering the second region b. As a result, the patterned mask oxide layer 107a is removed and the substrate 101 is exposed in the first region a. A thermal oxidation process is applied to the exposed surface of the substrate 101 in the first region a to form a first gate insulating layer 111 in the first region a (see FIG. 16). The patterned pad nitride layer 105a and the patterned pad oxide layer 103a are then etched to expose the substrate 101 in the second region b and the first gate insulating layer 111 is recessed to form first gate insulating layer 111a (see FIG. 17). A thermal oxidation process is applied to the surface of the substrate 101 in the second region b, forming a second gate insulating layer 113 (see FIG. 18). In the Kim, *et al.* process, the original pad oxide layer 103, the original pad nitride layer 105, and the original mask oxide layer 107 are used only as etch masks, and are completely removed in the eventual formation of the dual-thickness gate insulating layer 111a, 113.

Kim, *et al.* fails to teach or suggest “forming a gate dielectric layer including a thick portion formed” of a “first dielectric layer and remaining second dielectric layer and a thin portion formed of the exposed first dielectric layer”, the “second dielectric layer having different dielectric material from that of the first dielectric material”, as claimed in claim 1 of the present invention. Instead, in Kim, *et al.*, the pad oxide layer 103, the pad nitride layer 105, and the mask oxide layer 107 are used only as etch masks and are then fully removed in the eventual formation of the dual-thickness gate insulating layer 111a, 113. The pad oxide layer 103, the pad nitride layer 105, and the mask oxide layer 107 are not included in “a gate dielectric layer” of the

resulting device and therefore are not the "dielectric layers" used to form the "gate dielectric layer" as claimed. In addition, the first gate insulating layer 111a and the second gate insulating layer 113 which are formed in a thicker portion and a thinner portion respectively are formed of the same dielectric material. Therefore, Kim, *et al.* fails to teach or suggest a "second dielectric layer having a different dielectric material from that of" a "first dielectric material", as claimed in claim 1.

It is therefore submitted that independent claim 1 is allowable over Kim, *et al.* Reconsideration of the rejection of claim 1 under 35 U.S.C. 102(b) as being anticipated by Kim, *et al.*, and allowance of the claim, are respectfully requested. With regard to the rejection of dependent claims 2, 6 and 7 as being anticipated by Kim, *et al.*, it follows that these claims should inherit the allowability of the independent claim from which they depend.


New claims 20 and 21 are submitted above. Entry and allowance of claims 20 and 21 are respectfully requested.

#### Closing Remarks

It is submitted, assuming entry of the present Amendment, that all claims are in condition for allowance, and such allowance is respectfully requested. If prosecution of the application can be expedited by a telephone conference, the Examiner is invited to call the undersigned at the number given below.

Respectfully submitted,

Date: May 17, 2006  
Mills & Onello, LLP  
Eleven Beacon Street, Suite 605  
Boston, MA 02108  
Telephone: (617) 994-4900, Ext. 4902  
Facsimile: (617) 742-7774  
J:\SAM\0465\AmendD\amendmentd.wpd

  
Anthony P. Onello, Jr.  
Registration Number 38,572  
Attorney for Applicant